Project Definition Rating Index (PDRI) Revisited

Workshop

September 20, 2004

Workshop Participants

Edd Gibson, Moderator

Jay Hoover

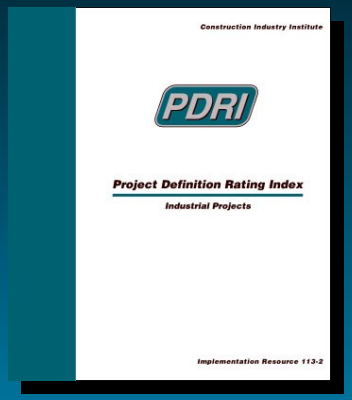
John Fish

Bob Herrington

Tim Albrecht

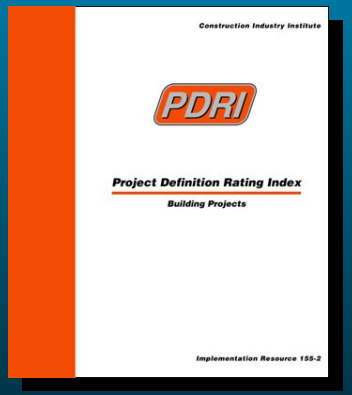
Javid Talib

PDRI Publications



PDRI Industrial Projects

CII Implementation Resource 113-2



PDRI Building Projects

CII Implementation Resource 155-2

http://www.construction-institute.org/pdri/cii-pdri.cfm

SECTION I - BASIS OF PROJECT DECISION

CATEGORY Element	Definition Level 0	1	2	3	4	5	Score
A. MANUFACTURING OBJECTIVES CRITERIA (Maximum Score = 45)							
A1. Reliability Philosophy	0	1	5	9	14	20	
A2. Maintenance Philosophy	0	1	3	5	7	9	
A3. Operating Philosophy	0	1	4	7	12	16	
CATEGORY A TOTAL							
B. BUSINESS OBJECTIVES (Maximum Score = 213)							
B1. Products	0	1	11	22	33	56	
B2. Market Strategy	0	2	5	10	16	26	
B3. Project Strategy	0	1	5	9	14	23	
B4. Affordability/Feasibility	0	1	3	6	9	16	
B5. Capacities	0	2	11	21	33	55	
B6. Future Expansion Considerations	0	2	3	6	10	17	
B7. Expected Project Life Cycle	0	1	2	3	5	8	
B8. Social Issues	0	1	2	5	7	12	
CATEGORY B TOTAL							
C. BASIC DATA RESEARCH & DEVELOPMENT (Maximum Score = 94)							
C1. Technology	0	2	10	21	39	54	
C2. Processes	0	2	8	17	28	40	
CATEGORY C TOTAL							
D. PROJECT SCOPE (Maximum Score = 120)							
D1. Project Objectives Statement	0	2				25	
D2. Project Design Criteria	0	3	6	11	16	22	
D3. Site Characteristics Available vs. Req'd	0	2				29	
D4. Dismantling and Demolition Req'mts	0	2	5	8	12	15	
D5. Lead/Discipline Scope of Work	0	1	4	7	10	13	
D6. Project Schedule	0	2				16	
CATEGORY D TOTAL							
E. VALUE ENGINEERING (Maximum Score = 27)							
E1. Process Simplification	0	0				8	
E2. Design & Material Alts. Considered/Rejected	0	0				7	
E3. Design For Constructability Analysis	0	0	3	5	8	12	
CATEGORY E TOTAL							

Section I Maximum Score = 499	**SECTION I TOTAL**	

Definition Levels

0 = Not Applicable
1 = Complete Definition
2 = Minor Deficiencies
3 = Some Deficiencies
4 = Major Deficiencies
5 = Incomplete or Poor Definition

PDRI Element Descriptions (Example)

A1. Reliability Philosophy

A list of the general design principles to be considered to achieve dependable operating performance from the unit. Evaluation criteria should include:

- Justification of spare equipment
- Control, alarm, and safety systems redundancy
- Extent of providing surge and intermediate storage capacity to permit independent shutdown of portions of the plant
- Mechanical / structural integrity of components (metallurgy, seals, types of couplings, bearing selection, etc.)

SECTION I - BASIS OF PROJECT DECISION

CATEGORY Element	Definition Level 0	1	2	3	4	5	Score
A. MANUFACTURING OBJECTIVES CRITERIA (Maximum Score = 45)							
A1. Reliability Philosophy	0	1	5	9	14	20	
A2. Maintenance Philosophy	0	1	3	5	7	9	
A3. Operating Philosophy	0	1	4	7	12	16	
CATEGORY A TOTAL							
B. BUSINESS OBJECTIVES (Maximum Score = 213)							
B1. Products	0	1	11	22	33	56	
B2. Market Strategy	0	2	5	10	16	26	
B3. Project Strategy	0	1	5	9	14	23	
B4. Affordability/Feasibility	0	1	3	6	9	16	
B5. Capacities	0	2	11	21	33	55	
B6. Future Expansion Considerations	0	2	3	6	10	17	
B7. Expected Project Life Cycle	0	1	2	3	5	8	
B8. Social Issues	0	1	2	5	7	12	
CATEGORY B TOTAL							
C. BASIC DATA RESEARCH & DEVELOPMENT (Maximum Score = 94)							
C1. Technology	0	2	10	21	39	54	
C2. Processes	0	2	8	17	28	40	
CATEGORY C TOTAL							
D. PROJECT SCOPE (Maximum Score = 120)							
D1. Project Objectives Statement	0	2				25	
D2. Project Design Criteria	0	3	6	11	16	22	
D3. Site Characteristics Available vs. Req'd	0	2				29	
D4. Dismantling and Demolition Req'mts	0	2	5	8	12	15	
D5. Lead/Discipline Scope of Work	0	1	4	7	10	13	
D6. Project Schedule	0	2				16	
CATEGORY D TOTAL							
E. VALUE ENGINEERING (Maximum Score = 27)							
E1. Process Simplification	0	0				8	
E2. Design & Material Alts. Considered/Rejected	0	0				7	
E3. Design For Constructability Analysis	0	0	3	5	8	12	
CATEGORY E TOTAL							
Section I Maximum Score = 499					**SECTION I TOTAL**		

Definition Levels

0 = Not Applicable
1 = Complete Definition
2 = Minor Deficiencies
3 = Some Deficiencies
4 = Major Deficiencies
5 = Incomplete or Poor Definition

Score Sheet Contents
PDRI for Industrial Projects

- **Section I: Basis of Project Decision**
  - Five categories, 22 elements
  - “Right project”
- **Section II: Front End Definition**
  - Six categories, 33 elements
  - “Right product”
- **Section III: Execution Approach**
  - Four categories, 15 elements
  - “Right way”

PDRI-Industrial

I. Basis of Project Decision

- **A. Manufacturing Objectives Criteria**
- **B. Business Objectives**
- **C. Basic Data Research and Development**
- **D. Project Scope**
- **E. Value Engineering**
- **F. Site Information**

II. Front End Definition

- **G. Process / Mechanical**
- **H. Equipment Scope**
- **I. Civil, Structural, and Architectural**
- **J. Infrastructure**
- **K. Instrument and Electrical**
- **L. Procurement Strategy**

III. Execution Approach

- **M. Deliverables**
- **N. Project Control**
- **P. Project Execution Plan**

Score Sheet Contents
PDRI Building Projects

- **Section I: Basis of Project Decision**
  - Three categories, 18 elements
  - “Right project”
- **Section II: Basis of Design**
  - Four categories, 32 elements
  - “Right product”
- **Section III: Execution Approach**
  - Four categories, 14 elements
  - “Right way”

PDRI for Buildings

I. Basis of Project Decision

- **A. Business Strategy**
- **B. Owner Philosophy**
- **C. Project Requirements**

II. Basis of Design

- **D. Site Information**
- **E. Building Programming**
- **F. Building/Project Design Parameters**
- **G. Equipment**

III. Execution Approach

- **H. Procurement Strategy**
- **J. Deliverables**
- **K. Project Control**
- **L Project Execution Plan**

Jay Hoover

Chief, Project Management Office Johnson Space Center

How is the PDRI used at NASA JSC?

- Best Practice on All Capital Projects > $0.5M
- Three (3) years of use
- ~ 45 Capital Projects
- Planning Office Tool -- Pre-Project Planning
- Project Mgmt Tool – Design Phase
- PDRI Score is Requested for Project Approval and Funding

Results at NASA JSC

- ~ 15 Projects in P3 Now
- ~ 15 Project in Design Now
- ~ 15 Project in Construction Now or Done
- Very Good Results – Problem Avoidance
- A Few Project Surprises
  - Unknown Field Conditions, Steel Costs, Limited Competition

Lessons Learned at NASA JSC:

- We Could Have Used This 10 Years Ago
- Feel High Success Rate
- It’s Not a Guarantee
- Teams Can Work Well by Starting Well
- PDRI and P3 Need Updating for New Security and LEED Changes

John Fish

Director Procurement and Quality Assurance

Ford, Bacon & Davis, LLC

Also representing:

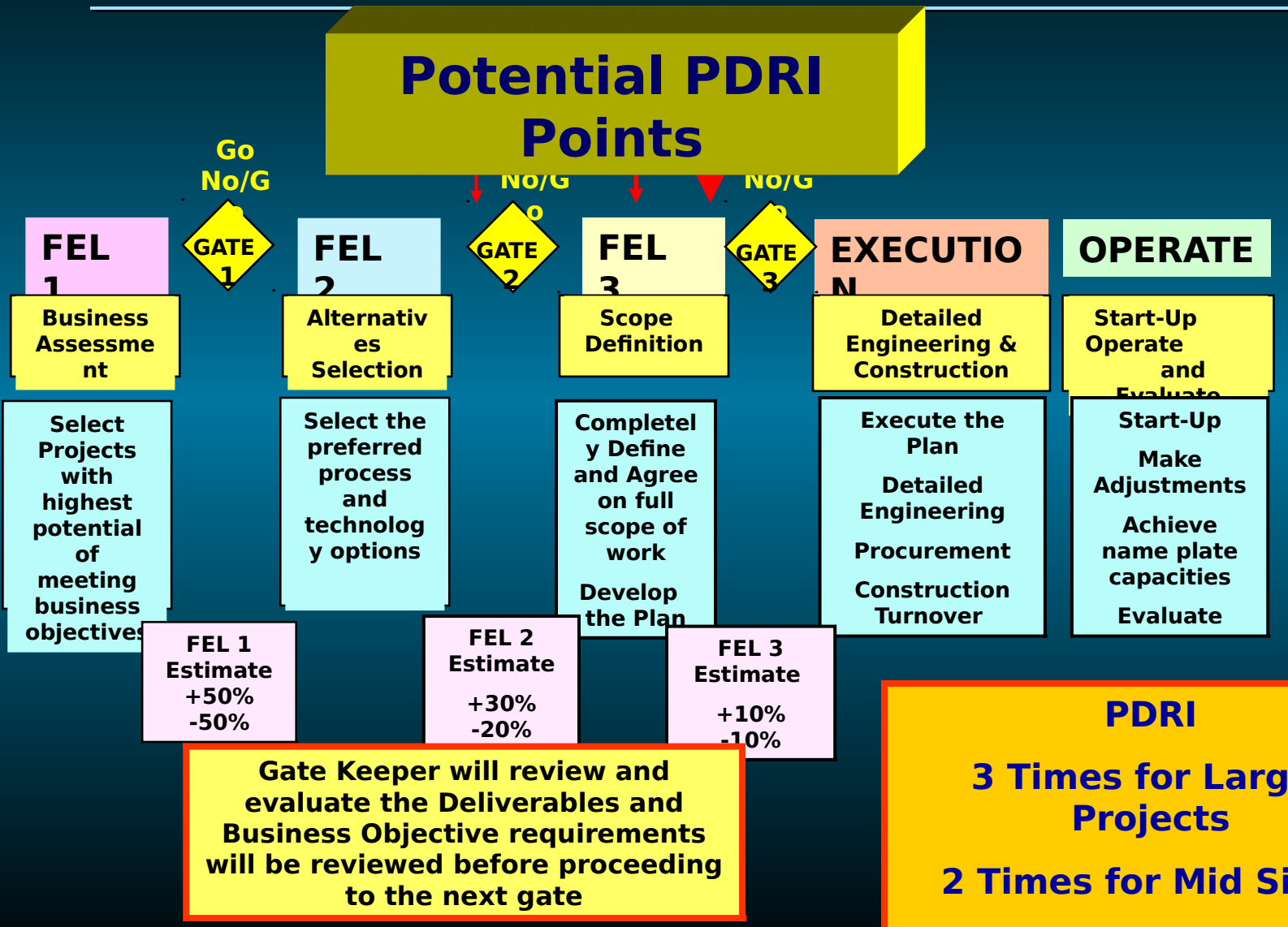
S&B Engineering & Construction, Ltd

Results at S&B/FB&D

- Pre-Project Planning Checklist - ***CONSISTENCY!!!***
- Communication & Team Alignment Tool
  - Help Communicate Business Drivers to Team.
  - Ensure Operations has buy-in
- Screen the WRONG project early.
- Provide Owner and Contractor a feedback tool across ALL projects.
- Emphasize the need for Best Practices IN FEL
- Importance of Business Drivers, Contracting Strategy, Turnover and Commissioning Planning in FEL.
- Leads Explain WHAT and HOW to satisfaction of Project Manager and Owner Team.

MANAGE THE INPUTS -- NOT OUTPUTS

FB&D GATED PROJECT DELIVERY SYSTEM



How is the PDRI used at S&B/FB&D

- Trained NON-Project Facilitators
- Large Projects - 2 or 3 times
  - Guide to Prepare Team for IPA
  - Alignment
  - Focus on Heavy Hitters/At Risk Items
- Multiple Small Projects 1 to 2 times
  - Team Alignment
  - Identify At Risk Items
  - 200 Score Required for Funding by owners
- Lump Sum EPC Bidding - Look for Risk/Weaknesses

Bob Herrington

Manager of Quality
Southern Region

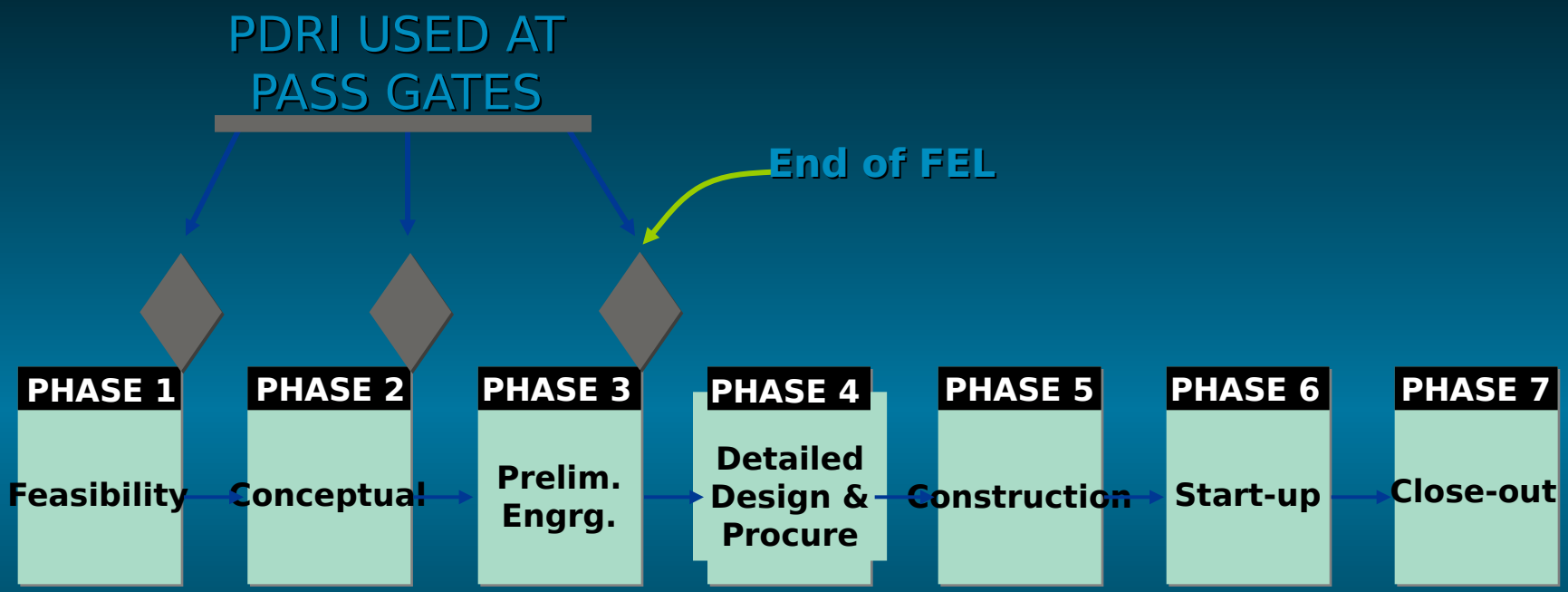
How is PDRI used at Jacobs?

- Implemented in 1995 with draft CII document
- Recognized formally in Jacobs EPC work process as ‘Value Enhancing Practice’
- Required use on all CPI capital projects > $2.0MM
- Employed formally at end of Phase 2 and 3 (Within FEL) to measure quality/completeness
- Used for tracking progress during FEL

How is PDRI used at Jacobs?

- Scoring and ‘Gap List’ reviewed in Pass Gate session, prior to proceeding into next project phase
- Utilized in addition to IPA FEL Assessment
- Used to evaluate 3rd party document quality & completeness

Jacobs Work Process Summary Map



Ongoing Activities: **JVEPs℠, Performance Measurements, Quality Audits, Client Satisfaction Surveys, Progress Reporting, Cost and Schedule Control, Total Value Added**

Results at Jacobs

- PDRI use has ….
  - attributed to more complete/consistent FEL packages
  - led to more successful project outcomes by driving completion of FEL
  - prevented proceeding to next project phase prematurely (reduced rework)
- PDRI ‘Gap List’ used by Teams to
  - complete FEL deliverables within schedule
  - assess risks and establish mitigation plans

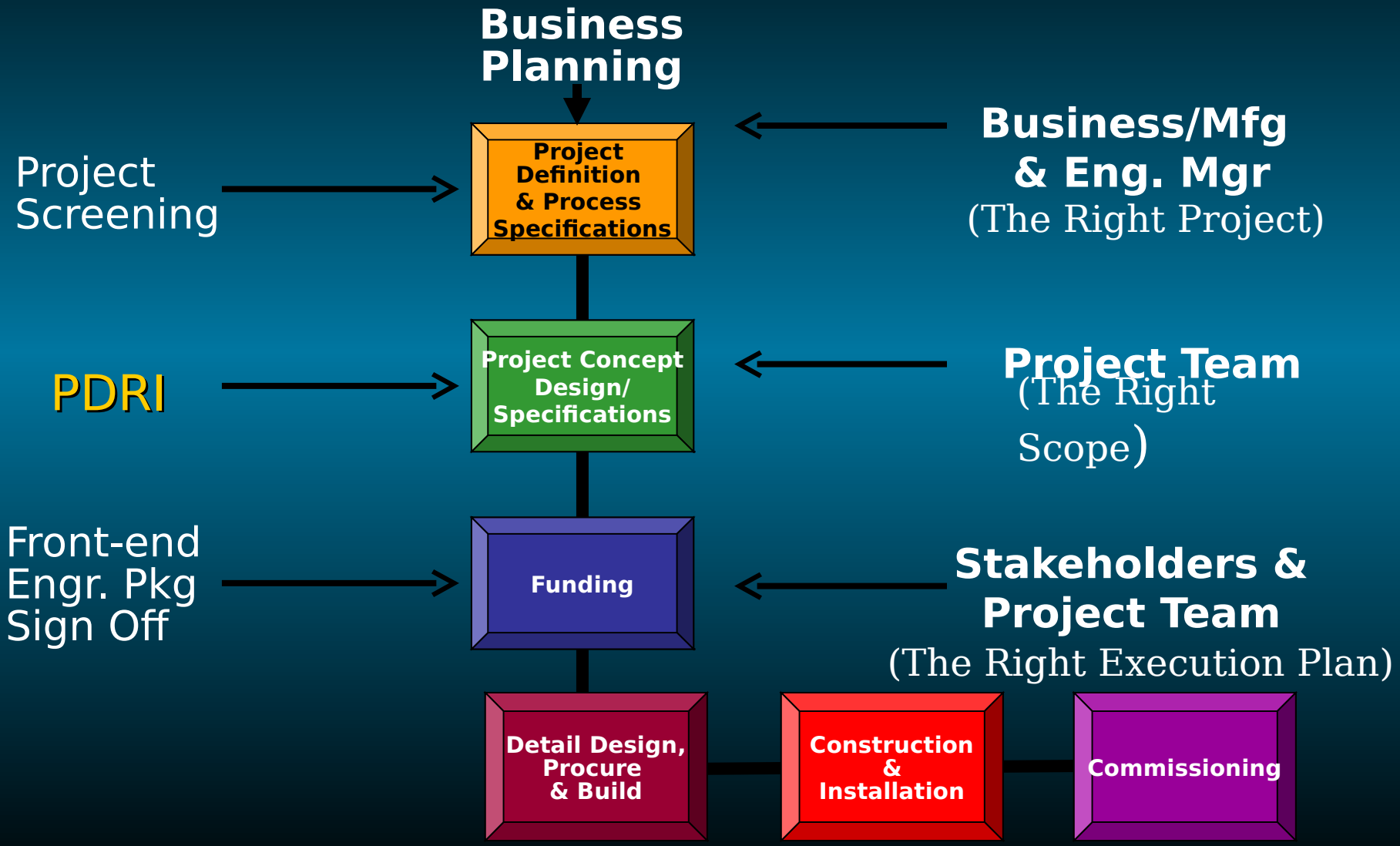
Lessons Learned at Jacobs

- PDRI sessions should be facilitated by internal 3rd party to obtain objective results
- Owner and multi-discipline participation improves results
- ‘Gap List’ is more valuable than “raw” score
- Interim use of PDRI provides excellent “Health Check” on project progress
- 3rd party packages improved through use of PDRI

Tim Albrecht

Engineering & Construction Contract Management

Capital Project Delivery Process at 3M



Evolution of PPP and PDRI at 3M

- 2000-2002: PPP, Alignment, and PDRI Training for Project Engineers (Edd Gibson)
- Requirement effective February 1, 2000, for Funding
- Integration of PDRI into our Project Management Process
  - Project Management Manual and Diagram (2000)
  - Front End Engineering Package (2003)
  - Alignment of Phases 1-3 to the PDRI Elements (2004)
- Project Management Sub-Team (Engineering Council) – 2004

PDRI Analyses

Over 137 PDRI Analyses Completed to Date as Requirement for Funding.

- 2000 (52) PDRI (147) Average Score
- 2001 (27) PDRI (156) Average Score
- 2002 (12) PDRI (177) Average Score
- 2003 (29) PDRI (171) Average Score
- 2004YTD (16) PDRI (189) Average Score

Lessons Learned- Process

- Use Early in Project
  - Review PDRI & Element Descriptions with Key Project Personnel
  - Checklist
- Front-end Engineering Requires Time & Resource Availability
- Process Flow Diagrams & P&ID’s should be Prepared Prior to Funding
- Need Measurements to Demonstrate Value of PDRI

"The real benefit of the PDRI will not be realized until the engineering community and (business) management are fully supportive of front-end engineering……"

Lessons Learned- Team

- Core Team Participates in At Least One Evaluation Meeting
  - Alignment of Stakeholders
  - Balanced & Quantitative Assessment of Scope Definition.
  - Excellent Communication Tool
  - Teaching Tool for Non-Engineering Personnel.

“The PDRI is really comprehensive….
More so than any other single document we use and it is an eye opener for lab, process, even division manufacturing clients….
……”

Lessons Learned- Facilitation

- Use a Facilitator from Outside the Project Team
- Challenge Project Team to have Element/Deliverable in Writing to Score Each Element as Completely Defined.
- Assemble Action List/Person Responsible

Javid Talib, P.E.

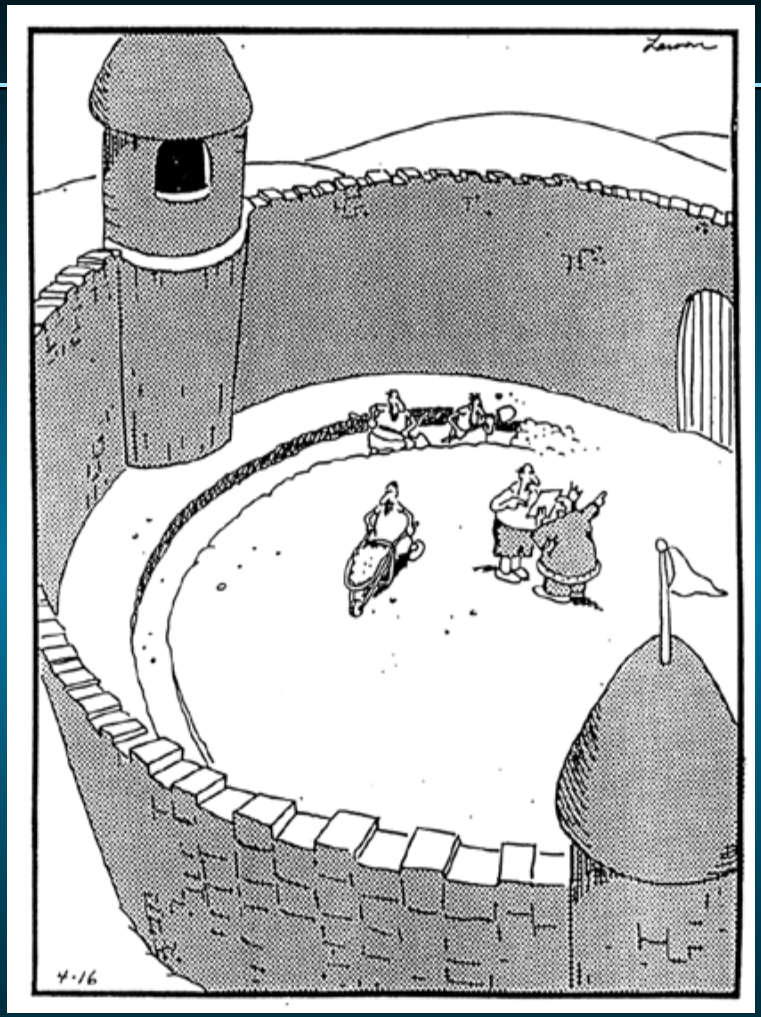
Senior Project Manager

Gas, Oil and Chemicals Division

Using PDRI at Black & Veatch

- PDRI (Industrial) – Operations Directive
- Standard Execution Approach – Quality Gate
  - Front End Engineering Design (FEED)
  - EPC
- Benchmarking/Client Gates / IPA
- Lump Sum EPC Bidding
- Great Tool for monitoring/Alignment

THE FAR SIDE By GARY LARSON



Suddenly, a heated exchange took place between the king and the moat contractor.

Results at Black & Veatch

- 20+ Projects
- Achieved 220 or Less for All FEED
- Well Defined FEED
- Good Correlation with Project Outcome

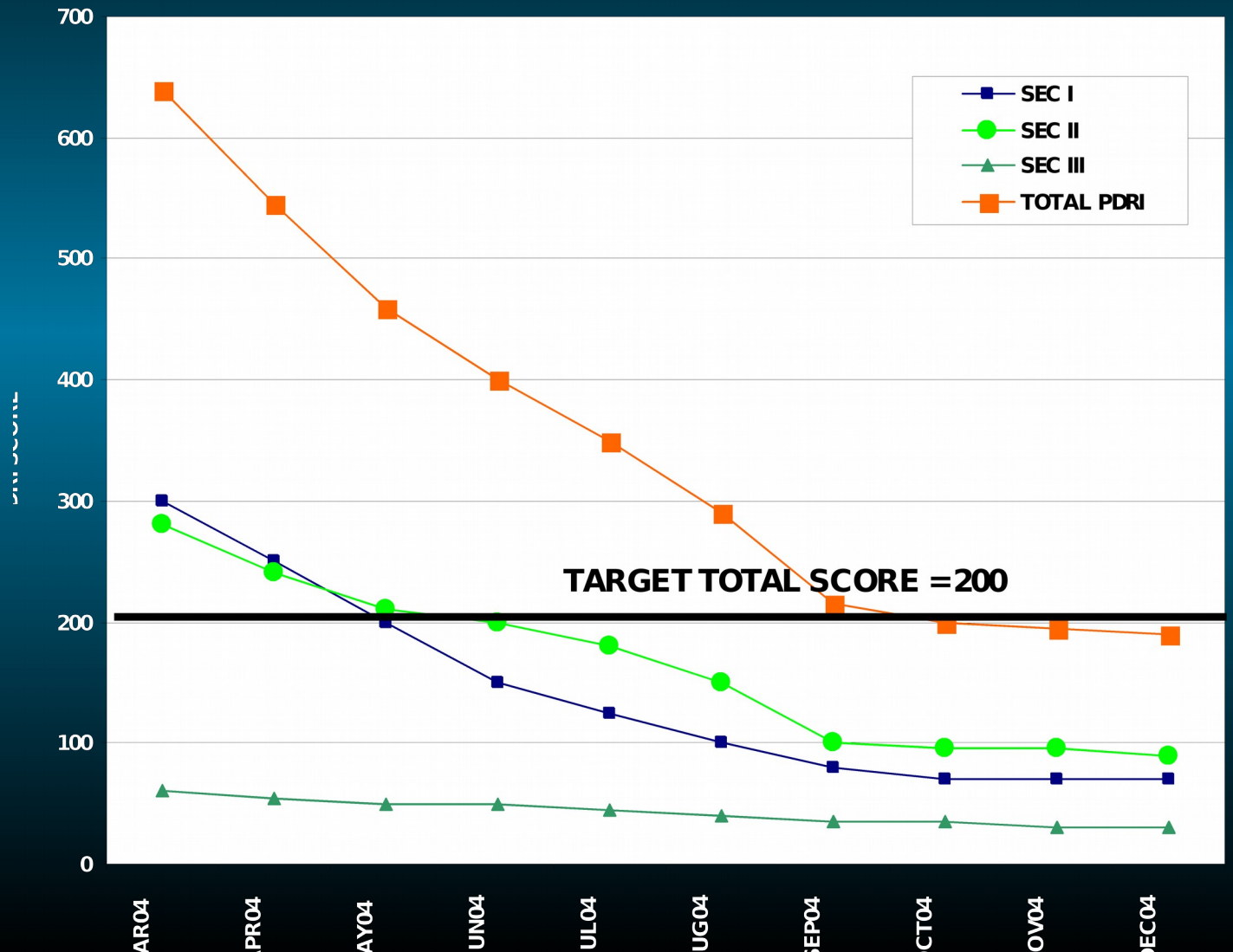
Implementation - How do we do it?

- Trained Facilitator
- Well Balanced Team/Participants
- Short Training Session for All Participants
- Maintain Same Participants
- Participant Come Prepared
- It’s a Team Effort!

Implementation - How do we do it?

- Automated Scoring Sheets
- Patience – Do Not Focus on Just Numbers
- Encourage Open Discussions - Consensus
- Use Action List
- Chart the Target Scoring

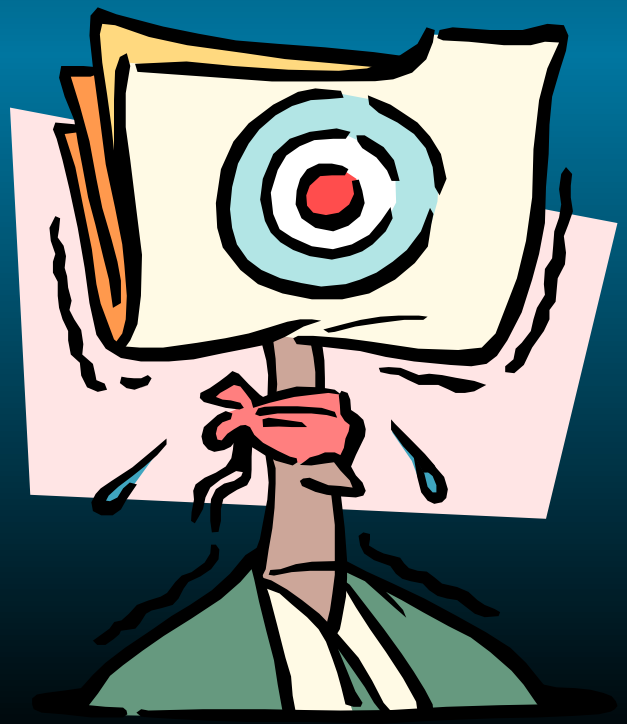
Charting Target PDRI Score Example



Implementation - How do we do it?

- Have Fun!

Questions?



Additional Slides

Comparison of Projects with PDRI Above and Below 200 — Industrial Projects

	PDRI Score	
Performance	**< 200**	**> 200**
Cost	4% below budget	6% over budget
Schedule	3% behind schedule	11% behind schedule
Change Orders	6% of budget	8% of budget
	(N=62)	(N=44)

PDRI – The Results

Example:

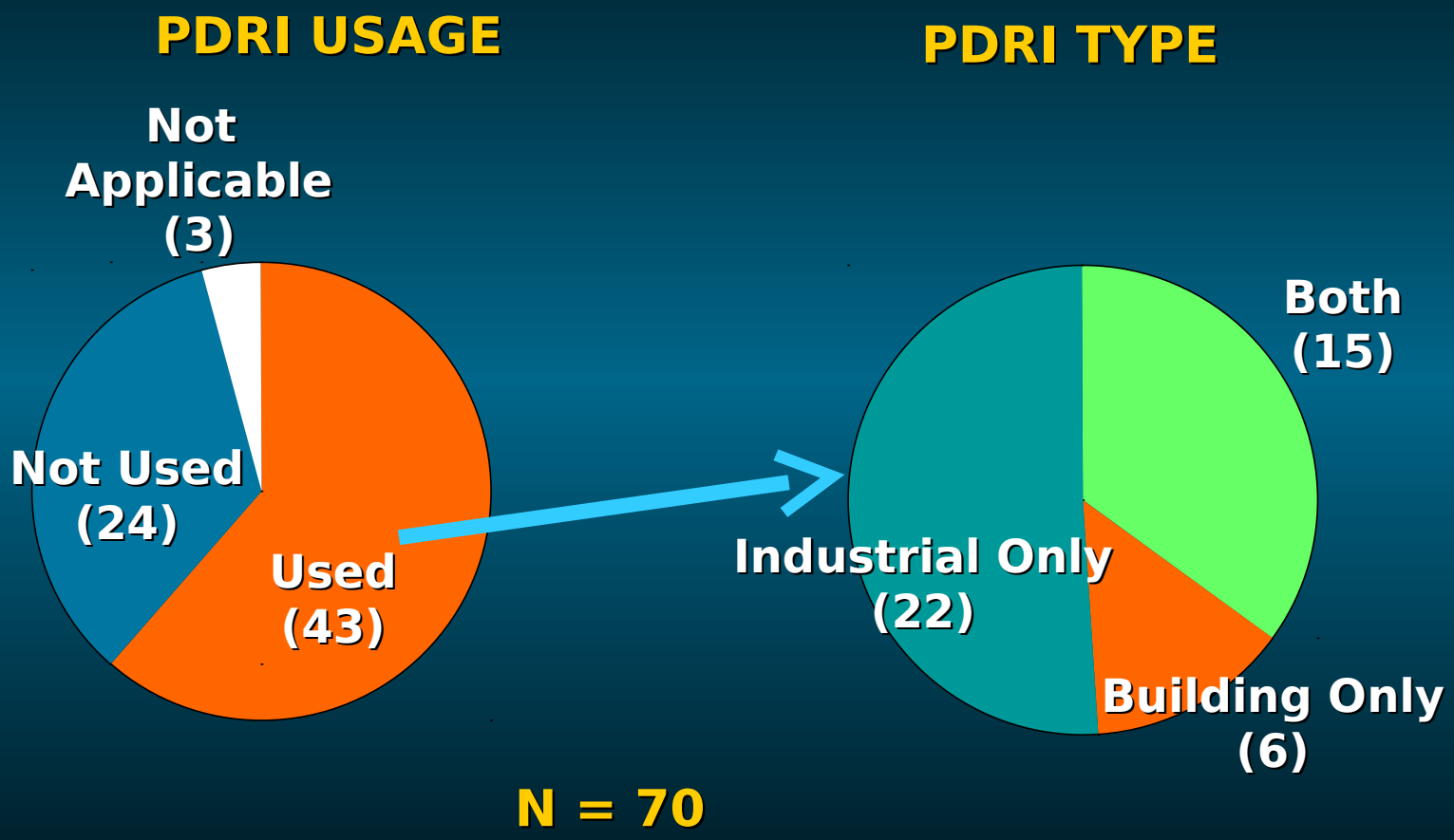
$55 Million Industrial Project, 24-Month Schedule

	< 200	> 200
Cost million	$53 million	$57
Schedule	24 months	26 months

Comparison of Projects with PDRI Above and Below 200 — Building Projects

	PDRI Score	
Performance	**< 200**	**> 200**
Cost	1% over budget	10% over budget
Schedule	on schedule	21% behind schedule
Change Orders	7% of budget	11% of budget
	(N=18)	(N=74)

PDRI Usage Among CII Members



Industrial Projects

Definition Level Average from 54 Industrial Projects

Definition Level Average Greater than 2.5	
K2 Logic Diagrams	3.1
G13 Instrument Index	2.9
P5 Start Up Requirements	2.8
G11 Tie-in List	2.8
G12 Piping Special Item List	2.8
G10 Line List	2.8
P4 Pre-Commissioni Turnover Sequence	2.7
K6 Instrument & Electrical Requirements	2.6
N3 Risk Analysis	2.6
I1 Civil/Structural Requirements	2.6
E3 Design for Constructability Analysis	2.6
P6 Training Requirements	2.6
G3 Piping & Instrumentation Diagrams	2.5
G7 Piping System Requirements	2.5

(Wang, 2002)

Industrial Projects

Top 10 Industrial Projects with Most Level 5 Definition	
K2 Logic Diagrams	27
N3 Risk Analysis	20
L3 Procurement Responsibility Matrix	18
M3 Distribution Matrix	14
D1 Project Objective Statement	12
E1 Process Simplification	12
E2 Design & Material Alterations Considered/Rejected	11
G13 Instrument Index	11
P3 Shut Down/Turn Around Requirements	11
P4 Pre-Commissioning Turnover Sequence Requirements	11

(Wang, 2002)

Building Projects

Definition Level Average from 78 Building Projects	
Definition Level Average Greater than 2.5	
E1 Program Statement	3.4
C1 Value Analysis Process	3.0
F7 Constructability Analysis	3.0
C5 Project Schedule Statement	2.8
A8 Project Objective Statement	2.7
C4 Scope of Work Overview	2.7
C6 Project Cost	2.7
F4 Mechanical Design	2.6
E11 Room Data Sheets	2.5

(Wang, 2002)

Building Projects

Top 10 Industrial Projects with Most Level 5 Definition	
E1 Program Statement	30
A8 Project Objective Statement	17
C1 Value Analysis	12
C4 Scope of Work Overview	11
F4 Mechanical Design	11
F5 Electrical Design	11
F7 Constructability Analysis	11
J2 Documentation/Deliverables	11
2 F1 Furnishings, Equipments, and Built-ins	9
C6 Project Cost Estimate	8

(Wang, 2002)

An Example

CATEGORY Element	Definition Level 0	1	2	3	4	5	Score
J. INFRASTRUCTURE (Maximum Score = 25)							
J1. Water Treatment Requirements							
J2. Loading / Unloading / Storage Facilities Req'mts							
J3. Transportation Requirements							
						CATEGORY J TOTAL	

Definition Levels

0 = Not Applicable
1 = Complete Definition
2 = Minor Deficiencies
3 = Some Deficiencies
4 = Major Deficiencies
5 = Incomplete or Poor Definition

See bottom of page 32 of IR 113-2, also page 58 of IR 113

J. INFRASTRUCTURE

J1. Water Treatment Requirements

Items for consideration should include:

- Wastewater treatment
- Process waste
  - Sanitary waste
  - Waste disposal
- Storm water containment & treatment

An Example

CATEGORY Element	Definition Level						Score
	0	1	2	3	4	5	
J. INFRASTRUCTURE (Maximum Score = 25)							
J1. Water Treatment Requirements			✓				
J2. Loading / Unloading / Storage Facilities Req'mts							
J3. Transportation Requirements							
						CATEGORY J TOTAL	

Definition Levels

0 = Not Applicable
1 = Complete Definition
2 = Minor Deficiencies
3 = Some Deficiencies
4 = Major Deficiencies
5 = Incomplete or Poor Definition

J. INFRASTRUCTURE

J2. Loading / Unloading / Storage Facilities Requirements

A list of requirements identifying raw materials to be unloaded and stored, products to be loaded along with their specifications, and Material Safety Data Sheets. This list should include items such as:

- Instantaneous and overall loading / unloading rates
- Details on supply and / or receipt of containers and vessels
- Storage facilities to be provided and / or utilized
- Specification of any required special isolation provisions
  - Double wall diking and drainage
  - Emergency detection (e.g. hydrocarbon detectors / alarms)
  - Leak detection devices or alarms

An Example

CATEGORY / Element	Definition Level 0	1	2	3	4	5	Score
J. INFRASTRUCTURE (Maximum Score = 25)							
J1. Water Treatment Requirements			✓				
J2. Loading / Unloading / Storage Facilities Req'mts	✓						
J3. Transportation Requirements							
					CATEGORY J TOTAL		

Definition Levels

0 = Not Applicable
1 = Complete Definition
2 = Minor Deficiencies
3 = Some Deficiencies
4 = Major Deficiencies
5 = Incomplete or Poor Definition

J. INFRASTRUCTURE

J3. Transportation Requirements (Y/N)

Specifications identifying implementation of "in-plant" transportation (e.g. roadways, concrete, asphalt, rock, etc.) as well as methods for receiving / shipping of materials (e.g. rail, truck, marine, etc.).

An Example

CATEGORY / Element	Definition Level 0	1	2	3	4	5	Score
J. INFRASTRUCTURE (Maximum Score = 25)							
J1. Water Treatment Requirements			✓				
J2. Loading / Unloading / Storage Facilities Req'mts	✓						
J3. Transportation Requirements						✓	
				CATEGORY J TOTAL			

Definition Levels

0 = Not Applicable
1 = Complete Definition
2 = Minor Deficiencies
3 = Some Deficiencies
4 = Major Deficiencies
5 = Incomplete or Poor Definition

An Example

CATEGORY Element	Definition Level						Score
	0	**1**	**2**	**3**	**4**	**5**	
J. INFRASTRUCTURE (Maximum Score = 25)							
J1. Water Treatment Requirements	0	1	3	5	7	10	
J2. Loading / Unloading / Storage Facilities Req'mts	0	1	3	5	7	10	
J3. Transportation Requirements	0	1				5	
				CATEGORY J TOTAL			

Definition Levels

0 = Not Applicable
1 = Complete Definition
2 = Minor Deficiencies
3 = Some Deficiencies
4 = Major Deficiencies
5 = Incomplete or Poor Definition

An Example (cont'd)

CATEGORY Element	Definition Level 0	1	2	3	4	5	Score
J. INFRASTRUCTURE (Maximum Score = 25)							
J1. Water Treatment Requirements	0	1	3	5	7	10	
J2. Loading / Unloading / Storage Facilities Req'mts	0	1	3	5	7	10	
J3. Transportation Requirements	0	1				5	
					CATEGORY J TOTAL		

Definition Levels

0 = Not Applicable
1 = Complete Definition
2 = Minor Deficiencies
3 = Some Deficiencies
4 = Major Deficiencies
5 = Incomplete or Poor Definition

An Example (cont'd)

CATEGORY Element	Definition Level						Score
	0	1	2	3	4	5	
J. INFRASTRUCTURE (Maximum Score = 25)							
J1. Water Treatment Requirements	0	1	(3)	5	7	10	3
J2. Loading / Unloading / Storage Facilities Req'mts	(0)	1	3	5	7	10	0
J3. Transportation Requirements	0	1				(5)	5
						CATEGORY J TOTAL	8

Definition Levels

0 = Not Applicable
1 = Complete Definition
2 = Minor Deficiencies
3 = Some Deficiencies
4 = Major Deficiencies
5 = Incomplete or Poor Definition